Chasing Z's: Sleep Quality and Bedsharing in Teen Moms

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Abstract

Pregnancy and motherhood during adolescence is a major U.S. public health concern, and teen mothers are likely to experience negative consequences given their status as a young mom. One potential intervention method lies within health behaviors, specifically sleep quality and bedsharing practices. Although research demonstrates relationships between specific types of sleep problems and pregnancy, little is known about the prevalence and type of sleep problems and bedsharing intentions for pregnant women from diverse backgrounds. This project aimed to investigate and describe sleep quality, including the factors that might affect sleep during pregnancy, as well as bedsharing intentions during the third trimester of pregnancy in adolescent women from a large Midwestern city. Participants in this study included a sample of female adolescents participating in a larger, longitudinal pilot study testing the feasibility and implementation of a multiple health behavior change intervention. Results of the current study suggest pregnant, adolescent women may experience poor sleep during their third trimester. It was also discovered that teen mothers are likely to choose co-sleeping for reasons such as distance and/access, preparation, and safety. The results of the current study have important implications for the care of these women and their families, as well as their medical care providers.

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During 2014, there were 249,078 live births to women aged 15-19 years and the birth rate for this population was 24.2 live births per 1,000 women (Hamilton, Martin, Osterman, Curtin, & Matthews, 2015). Additionally, birth rates vary across racial/ethnic groups such that in 2014, the birth rates for non-Hispanic black and Hispanic women aged 15-19 years were 34.9 and 38.0 per 1,000 women respectively (Hamilton et al., 2015). Adolescent pregnancy is a major U.S. public health concern and was estimated to increase societal costs by $9.4 billion in 2010 (Centers for Disease Control and Prevention [CDC], 2016a). Teen pregnancy is a known risk factor for a number of negative health outcomes. For instance, the infant mortality risk is higher for babies born to mothers younger than 20 years of age when compared to babies born to mothers who are 20 to 39 year-old women (Mathews & MacDorman, 2013), and the risk is likely to be particularly high for African American infants. According to Mathews and MacDorman (2013), infant mortality rates in 2009 for non-Hispanic blacks were double the rates for non-Hispanic white and Hispanic individuals.

Similarly, given the public health and individual concerns regarding teen mothers and their offspring, it is important to intervene where possible. Injuries (i.e., suffocation) and Sudden Infant Death Syndrome (SIDS) have been identified as causes of infant mortality (CDC, 2016b). Thus, one potential intervention method may be related to health behaviors such as sleep quality and co-sleeping tendencies. By identifying specific aspects of maternal sleeping patterns and the motivations behind co-sleeping practices, we may be able to effectively support these mothers and their children.

Sleep During Pregnancy

Though we don't know much about sleep during adolescent pregnancy, sleep problems during pregnancy are common with reports of sleep quality decreasing across the duration of pregnancy. Research suggests that changes in sleep patterns are documented within the first trimester of pregnancy (Lee, Zaffke, & McEnany, 2000) and that a large portion of women report problems with sleep in later stages of pregnancy. Difficulties with sleep during pregnancy are known to be due to hormonal shifts and physical discomforts, including increased frequency of urination, nocturnal leg cramps, and fetal movement (Mindell & Jacobson, 2000). The consequences of sleep deprivation in the general population are well-documented, but the adverse effects of poor sleep in pregnancy are also of high importance. Results from a recent review on sleep deprivation during pregnancy and maternal and fetal outcomes suggest that short sleep duration has many negative maternal and fetal outcomes, including longer and more painful labor and delivery, increased rates of maternal postpartum depression, and higher rates of preterm birth and cesarean section delivery (Chang, Pien, Duntley, & Macones, 2010). Given the detrimental physical and mental health outcomes of sleep deprivation during pregnancy, it is crucial to understand the prevalence and types of sleep problems that occur during pregnancy in order to target a potential intervention method in this population.

In a sample of women interviewed between 28-29 weeks gestation, approximately two-thirds of participants reported problems sleeping (Pien, Fife, Pack, Nkwuo, & Schwab, 2005). One of the common reports of problematic sleep patterns during pregnancy is decreased total sleep duration. Research suggests that this pattern can begin in the second trimester (Hedman, Pohjasvaara, Tolonen, Suhonen-Malm, & Myllyla, 2002), continue through the third trimester (Facco, Kramer, Ho, Zee, & Grobman, 2010; Hutchinson et al., 2012), and even persist into the first three months after delivery (Hedman et al., 2002).

As pregnancy advances, other problematic sleep patterns are common. These include decreases in sleep quality, increases in snoring and daytime sleepiness, more napping (Facco et al., 2010; Hutchinson et al., 2012), as well as more frequent night awakenings and difficulty falling asleep (Mindell & Jacobson, 2000). In addition, the literature also suggests that sleep becomes more fragmented and restless as pregnancy advances leading to higher numbers of sleep disturbances in the third trimester (Hedman et al., 2002). Compared to overall decreases in sleep quality and quantity, a less well-documented sleep problem during pregnancy is restless leg syndrome (RLS). Facco and colleagues (2010) report that, in a diverse sample of women, the proportion of women who met diagnostic criteria for RLS significantly increased by the third trimester.

Although previous work suggests various sleep disturbances occur during pregnancy, there are limitations to the existing body of literature. While many studies have examined the prevalence and types of sleep problems during pregnancy, most of this research involves samples lacking racial/ethnic diversity (Facco et al., 2010; Hutchinson et al., 2012; Okun, Kiewra, Luther, Wisniewski, & Wisner, 2011). Additionally, previous research on sleep problems during pregnancy have included samples with mean maternal ages ranging from 23 to 31 years old (Facco et al., 2010; Hall et al., 2009; Hedman et al., 2002; Mindell & Jacobson, 2000; Okun et al., 2011; Pien et al., 2005). Considering sleep duration is associated with numerous health-risk behaviors in the non-pregnant adolescent population (McKnight-Eily et al., 2011) and the negative maternal and fetal outcomes associated with sleep deprivation in pregnancy (Chang et al., 2010), identifying and describing problematic sleep patterns in pregnant adolescents is critical for teen mothers and their babies. Attempting to target sleep behavior in the adolescent

mother population has the potential for intervention in order to limit the number of negative consequences for teen mothers and their offspring.

Sleep During Pregnancy: Adolescence, SES, and Race/Ethnicity

Although no studies to date have examined sleep quality and types of sleep problems in a sample of strictly adolescent pregnant women or teen mothers, a few studies have investigated sleep patterns in diverse samples and samples including women less than 19 years of age. Through a qualitative study designed to identify health behavior patterns in low-income pregnant women, Lewallen (2004) found that participants indicated activity and rest as two major categories of health behaviors. This group of predominantly African American women indicated they "rested a lot" and were "careful to get enough sleep" (Lewallen, 2004, p. 203). In another study of predominantly (90%) African American women, changes in sleep-disordered breathing were studied across pregnancy from first to third trimester. Pien and colleagues (2005) found that sleep-disordered breathing and symptoms of sleep apnea (i.e., subjective daytime sleepiness) increased significantly from the first trimester to delivery. Lastly, other studies have investigated sleep alterations (e.g., total sleep duration per night, sleep quality, frequency of snoring) during pregnancy utilizing samples with a small proportion of women less than 20 years of age (Hedman et al., 2002; Hutchinson et al., 2012), which demonstrates the lack of research on sleep quality in young, pregnant women. Although there is evidence for problematic sleep in pregnant women from minority racial groups (Lewallen, 2004; Pien et al., 2005), no studies have been identified that describe sleep alterations across pregnancy in a sample of racially-diverse, adolescent women.

There are many risk factors for sleep deprivation and poor sleep quality. In the general population, some of these risk factors include living alone, low subjective societal status, and

long work hours (Kushida, 2004). Additionally, other factors related to high-risk populations are associated with poor sleep quality and sleep deprivation. For example, income level has been established as a risk factor for sleep patterns. Kushida (2004) notes that low-income level is a risk factor for sleep problems in the non-pregnant population. In a sample of aging women, socioeconomic status, as determined by household income and educational attainment, predicted sleep efficiency and latency (time from full wakefulness to sleep) as well as total scores on the Pittsburgh Sleep Quality Index (PSQI; Friedman et al., 2007). Besides low-income level and socioeconomic status, racial/ethnic status may also be related to sleep quality and nighttime disturbances.

Minority racial status has also been found to be a risk factor for problematic sleep patterns in the general population (Kushida, 2004). The Pittsburgh Sleep SCORE Project examined the effects of race and socioeconomic status on self-reported and objectively measured sleep. In this sample of 187 adults, Mezick and colleagues (2008) concluded that African American individuals may be at risk for sleep alterations and the associated health consequences. When compared to Caucasian and Asian people, African American sleep duration was shorter, sleep latency was longer (i.e., longer time to fall asleep), sleep continuity was less smooth, and less time was spent in stages three and four of sleep (Mezick et al., 2008). Finally, Facco and colleagues (2010) note that lower levels of sleep quality were associated with African-American and Hispanic racial status. Previous work has demonstrated that both socioeconomic and racial/ethnic status are associated with problematic sleep patterns, yet little research is available to demonstrate these relationships during pregnancy.

Lastly, mental and physical health indicators may serve as risk factors for poor sleep quality. Previous work suggests that weight status, as measured by the Body Mass Index (BMI),

is related to sleep quality in non-pregnant women (Sahlin, Franklin, Stenlund, & Lindberg, 2009). Similarly, Facco and colleagues (2010) note that obese weight status is related to poor sleep quality in pregnant women. Another risk factor is depressive symptoms. In a study of diverse pregnant women, participants with depressed mood reported significantly more problematic sleep during the second trimester (Field et al., 2007). Additionally, depressive symptoms and sleep disturbances have been found to be significantly related during the early and middle stages of pregnancy (Field et al., 2007; Jomeen & Martin, 2007). Given relationships between physical and mental health and sleep quality (Facco et al., 2010, Field et al., 2007; Jomeen & Martin, 2007; Sahlin et al., 2009) and research demonstrating minority racial status as a risk factor for poor sleep (Facco et al., 2010; Mezick et al., 2008), it may be that differences in sleep are attributed to physical and mental health status within racial groups.

For example, it is possible that differences in weight status are linked to problematic sleep in various racial groups. According to the CDC (2015), there are differences in prevalence of obesity for non-Hispanic blacks (47.8%), Hispanics (42.5%), non-Hispanic whites (32.6%), and non-Hispanic Asians (32.6%). Additionally, differences in mental health difficulties may also be an explanation for racial status as a risk factor for poor sleep quality. Research demonstrates that African Americans, Hispanics, and Caucasians display different rates of major depression (Dunlop, Song, Lyons, Manheim & Chang, 2003). Taken together, it is possible that physical and mental health differences within racial groups may contribute to poor sleep quality in these groups. Although previous work demonstrates relationships between physical and mental health characteristics and sleep quality in pregnant women, more investigation is needed into these relationships among populations of high-risk pregnant women.

Bedsharing

A topic that has received, and continues to receive, much attention in the psychological and pediatric literature is parent-infant co-sleeping. Although co-sleeping is often used interchangeably with behaviors such as bedsharing and roomsharing, these terms are not synonymous. McKenna and Volpe (2007) define co-sleeping as a group of behaviors characterized by the presence of one or more adult caregiver(s) that sleeps close enough to the infant that parent and infant could exchange sensory processes (e.g., touch, sight, etc.). Co-sleeping can take many forms. *Bedsharing*, for instance, has been defined as a type of co-sleeping that involves the parent(s) and infant sleeping together on the parent's bed surface (Goldberg, & Keller, 2007). Alternatively, McKenna and colleagues (1993) define bedsharing as the parent(s) or caregiver(s) and infant sleeping next to each other on the same surface, which is typically a mattress and bedframe (as cited in Goldberg & Keller, 2007). Another type of co-sleeping is identified as *roomsharing*, a phenomenon in which the parent(s) or caregivers(s) and infant sleep in the same room but the infant sleeps on a different surface in close proximity to the parental or caregiver bed (e.g., crib or bassinet; McKenna & Volpe, 2007). Although similar in nature, the type of co-sleeping has implications for parent-child health outcomes.

Bedsharing has been a topic of controversy for many reasons. Not only are research findings on the topic contradictory (e.g., risks and benefits), but practitioner guidelines are not consistent and cultural norms for young children's sleep arrangements are highly variable. The risks and benefits associated with bedsharing have been heavily researched. Opponents of bedsharing emphasize that there is an increased risk for accidental asphyxiation, frequently caused by overlying of another individual, entrapment in the bed structure (Nakamura, Wind, & Danello, 1999), and an increased risk for Sudden Infant Death Syndrome (SIDS; Scragg et al., 1993). Studies have also demonstrated that children's sleep is negatively affected by sharing a

sleeping surface with one or more parents or caregivers (e.g., waking up during the night, bedtime struggles, etc.), particularly for children from minority racial groups (Lozoff, Wolf, & Davis, 1984; Schachter, Fuchs, Bijur, & Stone, 1989). Furthermore, in a study of high-income Caucasian mothers, poor maternal sleep was associated with sleeping in the same room as the baby (Lillis, Hamilton, Pressman, & Khou, 2016). Contrary to conventional thought, other research has demonstrated that bedsharing was also associated with lower levels of mother-infant bonding among a sample of primarily high-income Caucasian mother-child dyads (Mitchell, Hutchison, Thompson, & Wouldes, 2015). Although research suggests a number of potential negative outcomes of parent-infant bedsharing, there is evidence to suggest that bedsharing can be beneficial to families.

Proponents of bedsharing focus on the potential for bedsharing to facilitate breastfeeding (Ball, 2003) and promote autonomous behavior early in childhood (i.e., social independence and dressing oneself; Keller & Goldberg, 2004). The results of these studies demonstrate the potential benefits of young children and parent(s) or caregiver(s) sharing the same sleep surface. However, many of these findings used samples with little ethnic and socioeconomic diversity (Ball, 2003; Keller & Goldberg, 2004; Mitchell et al., 2015). Given the research suggesting potential risks (Lillis et al., 2016; Mitchell et al., 2015; Nakamura et al., 1999; Scragg et al., 1993) and benefits (Ball, 2003; Keller & Goldberg, 2004) of bedsharing, prevalence of these sleeping arrangements are also important to understand, especially in diverse populations.

Given the various applications of the term ‘co-sleeping’ in the literature, prevalence rates for specific early childhood sleeping arrangements are difficult to determine. Rates of bedsharing during the child’s first year of life have been demonstrated to be as low as eight to ten percent (Jenni, Fuhrer, Iglowstein, Molinari, & Largo, 2005; Mitchell et al., 2015) or as high as 35-45%

in studies of predominantly Caucasian families (Germo, Chang, Keller, & Goldberg, 2007; Lozoff et al., 1984). On average, prevalence rates for bedsharing practices in other ethnoracial groups are higher than in predominantly Caucasian samples.

Previous work has investigated bedsharing during the child's first year in both Hispanic American and African American children (e.g., Brenner et al., 2003; Lozoff et al., 1984; Schachter et al., 1989). For example, studies have demonstrated that approximately 48-70% of African American families bedshare (Brenner et al., 2003; Lozoff et al., 1984), 21% of Hispanic American parent-child dyads bedshare, and 80% of Hispanic American families participate in roomsharing (i.e., parent and child in same room, not same surface; Schachter et al., 1989) during the first few years of childhood. Finally, it should be noted that bedsharing practices are not always intentional. One study investigated the bedsharing intentions and post-delivery sleeping practices of mothers and their infants across the first three months postpartum. Krouse and colleagues (2012) found that even though no mothers intended to bedshare at the time of delivery, 60% of the mothers reported bedsharing at some point within the first 30 days of being discharged. These results suggest that mothers may not plan to sleep in the same bed prior to the birth of the baby, but that bedsharing happens.

Previous studies have also investigated the motivations behind bedsharing decisions. Research suggests that African American and Caucasian mothers choose to bedshare with their infant for convenience reasons (e.g., breastfeeding and post-delivery recovery; Germo et al., 2007; Joyner, Oden, Ajao, & Moon, 2010). Other reasons to bedshare early in the child's life include the child's emotional security, lower levels of maternal distress, physical closeness to the infant, space/availability, and comfort (e.g., baby sleeps better on parental bed, baby dislikes crib or bassinet, better sleep quality for parent when bedsharing; Chianese, Ploof, Trovato, & Chang,

2009; Germo et al., 2007; Joyner et al., 2010). In addition, it is important to consider that a mother may sleep on the same surface as her baby out of necessity (e.g., inability to afford purchase of a crib or bassinet; Brenner et al., 2003; Joyner et al., 2010). Of further note is the evidence suggesting unsafe bedsharing practices are more frequently observed in the urban poor (McKenna & Volpe, 2007). These results suggest that further research is needed to understand more about the reasons in which mothers choose to bedshare, especially among high-risk families.

Though research has investigated the prevalence of bedsharing as well as the associated reasons for infant sleep locations, very little investigation has been done in samples of diverse and high-risk young mothers. Some studies have included mothers younger than 20 years of age (Brenner et al., 2003; Chianese et al., 2009; Joyner et al., 2010; Krouse et al., 2012), but no identified studies have investigated the prevalence of and motivations behind bedsharing practices in strictly teen mother populations. Understanding more about the motivations behind bedsharing is critical for maternal and infant outcomes, but also for gaining more insight to inform practitioners and physicians as to why mothers are choosing to bedshare or room share for future intervention purposes.

The Current Study

A wide body of research demonstrates the prevalence of problematic sleep patterns across pregnancy (e.g., shorter duration, decrease in sleep quality, etc.), but little research has examined these patterns in more high-risk populations. Specifically, no studies have described sleep quality and disturbances in samples of adolescent mothers. Thus, the current study aimed to describe global and specific sleep patterns during the third trimester of pregnancy for expecting adolescent mothers.

Similarly, very little research has been conducted on bedsharing intentions and the associated reasons for infant sleep location in diverse samples of young mothers. Therefore, the current study aimed to investigate pre-partum, mother-infant co-sleeping (i.e., roomsharing and bedsharing) intentions and the factors associated with the chosen infant sleep location for young mothers in the third trimester. Quantitative and qualitative analyses were involved in determining infant sleep location and the associated motivations for bedsharing in this sample of primiparous adolescent mothers.

Lastly, the current study aimed to identify risk factors for poor sleep quality during pregnancy for young adolescent mothers. Given research suggesting socioeconomic status (SES) as a risk factor for poor sleep (Friedman et al., 2007; Kushida, 2004), the current study proposed to analyze the relationship between SES and sleep quality at 30-31 weeks gestation. Additionally, the current study proposed to examine the relationship between Body Mass Index (BMI) and sleep quality, based on the work by Faco and colleagues (2010). The current study also proposed to analyze the relationship between prenatal depressive symptoms and sleep quality. This analysis is based on previous research suggesting a relationship between depression and sleep quality in pregnant women (Field et al., 2007; Jomeen & Martin, 2007). The results of the current study have the potential to inform the field regarding a specific set of health behaviors in adolescent mothers, specifically mothers who may experience difficulties and distressed related to their status as a teen mother.

Research Questions/Hypotheses

1. Describe sleep quality in a diverse, primiparous adolescent sample.
2. Identify how many women plan to co-sleep (room share or bedshare) and motivations for choosing that sleep location for the infant.

3. It was predicted that a) socioeconomic status (as measured by income level; Hypothesis 1), higher Body Mass Index (BMI; Hypothesis 2), and higher symptoms of depression (Hypothesis 3) would be negatively related to poorer overall sleep quality ratings.

Method

Participants and Procedure

Participants. The sample for this study included six female, pregnant adolescents participating in a larger, longitudinal pilot study testing the feasibility of a multiple health behavior change intervention that utilizes the use of secure mobile devices to deliver educational and intervention materials. Participants were recruited through a local obstetrics and gynecology (OB/GYN) practice and family clinic at 26-30 weeks gestation. Mean maternal age was 17.67 years (SD = 1.36 years), and the majority (66.7%) of adolescents reported being single at the time of the home visit. Fifty percent of the participants reported receiving help from the baby's father during the pregnancy. Moreover, 50% of the sample reported receiving help from other individuals, including a grandparent, aunt, and the baby's paternal grandmother. Lastly, the majority (66.7%) of the sample endorsed middle school as the highest level of educational attainment.

Inclusion criteria for the study included adolescent age (15-19 years), stage of pregnancy at 26-30 weeks gestation, first baby, and intention to keep the newborn. Exclusion criteria included experiencing prenatal complications, experiencing a diagnosed depressive episode or other mental health condition that could impact participation (e.g., psychosis), and non-English speaking. The study was approved by the Institutional Review Board (Human Subjects Committee) at University of Kansas Medical Center.

Procedure. Interested and eligible participants were informed about all aspects of the study, including the format and data collection schedule. Participants had a chance to ask questions about the study to assure informed consent. Mothers agreeing to take part in the study completed the informed consent procedures and gave permission for researchers to access obstetrical medical records. Based on previous intervention research with pregnant adolescents, these pregnant adolescents (minors) signed their own consent form. All participants filled out the informed consent in a private room or area in the clinic or during the home visit (approximately 30 weeks gestation) with a member of the research team.

All consented participants received an in-home visit from a research team member, who administered baseline data collection and delivered an iPad mini (16GB) for study use. Participants were taught how to use the tablet and provided with phone numbers to call in case of technical issues. In addition, each participant read and signed an iPad Loan and Use Agreement form (see Appendix C). The iPads were provided to study participants with data plans (5GB Data Plan by AT&T Wireless) for consistent, reliable delivery of data collection materials. All participant information was removed and the iPads were sanitized per the manufacturer and KUMC policies once returned upon study completion.

During the home visit (at approximately 30 weeks gestation), participants completed questionnaires regarding demographic information, as well as the Pittsburgh Sleep Quality Index (PSQI), the Edinburg Postnatal Depression Scale (EPDS), and their height and weight was collected. Participants were instructed to complete two daily sleep diaries for the week following the home visit. Participants completed all measures using an online database (REDCap; Research Electronic Data Capture) on the iPad mini. Participants were thanked for their time and cooperation and received $15 total in gift card form upon completion of the entire study.

Measures

Demographic and body measurement data. Participants completed a brief demographics questionnaire during the home visit at approximately 30 weeks gestation. Participants were asked to report their age, marital status, educational and occupational status, as well as the baby's due date and pre-pregnancy weight. Current height and weight was collected during this home visit using a portable scale and stadiometer. See Appendix D for demographic-specific survey questions.

Depressive symptoms. The Edinburgh Postnatal Depression Scale (EPDS; Cox, Holden, & Sagovsky, 1987), a 10-item, self-report questionnaire, is a widely used instrument of assessing postpartum depression and was used to assess depressive symptoms during the home visit. The EPDS has established psychometric properties (Cox et al., 1987) and has also been validated for use in antenatal women (Gaynes et al., 2005), in addition to high accuracy in identifying postpartum depression in adolescents (Gaynes et al., 2005). Each item response is coded from 0 to 3, and the maximum score is 30. A cutoff score of 10 or higher is indicative of major depressive disorder with sensitivity of greater than 90% and specificity greater than 80% (Gibson, McKenzie-McHarg, Shakespeare, Price, & Gray, 2009).

Sleep quality. The Pittsburgh Sleep Quality Index (PSQI) was used to assess participants sleep quality (Buysse, Reynolds, Monk, Berman, & Kupfer, 1989). The PSQI, a 19-item, self-report questionnaire, is widely used in assessment of overall sleep quality and disturbances over a one-month time interval and has established psychometric properties (Buysse et al., 1989). Items generate seven component scores, each weighted on a 0-3 scale: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medication, and daytime dysfunction. The seven component scores are then summed to yield a global PSQI score with a maximum score of 21 indicating worse sleep. A score of five or higher

qualifies the person as a "poor sleep." Five additional questions are rated by a bedpartner or roommate and are not included in the generation of the global PSQI score. The PSQI was administered at the home visit.

Pre-partum sleep and bedsharing intentions. During the week following the home visit, participants completed seven days of AM and PM sleep diaries. On the morning of the first day participants were sent a short baseline diary assessing co-sleeping intentions (i.e., "Where do you plan for your baby to sleep once s/he is born?") and motivations influencing the infant sleep location ("Why do you plan to have your baby sleep in the location you indicated above?"). In the morning on days two through seven, participants were sent the AM version of the pre-partum daily diary assessing sleep duration (i.e., How long did you sleep last night?"), sleep quality (i.e., "Please indicate your quality of sleep last night"), and number of awakenings during the previous night ("How many times did you wake up during the night?"). Sleep quality was assessed on a scale of 1 through 10 with 10 being the highest score. In the evening for all seven days of daily sleep diary collection, participants were sent the PM version of the pre-partum daily diary assessing total number of naps (i.e., "How many minutes did you nap today in total?") and feelings of sleepiness (i.e., "How sleepy did you feel today?") and fatigue ("How fatigued did you feeling today?") during the day. Sleepiness and fatigue were reported on a scale of 1 through 10 with 10 being the highest value (e.g., ten being "very sleepy" or "very fatigued"). Daily diary surveys were delivered to participants via REDCap, and they likely used the iPad to complete diaries each day. See Appendix E for daily sleep diary survey questions.

Analytic Approach

Data were analyzed in IBM SPSS Statistics Version 24. To answer the first research question, mean Pittsburgh Sleep Quality Index (PSQI) scores and subscale scores were

calculated. Additionally, aggregate sleep duration, sleep quality, daytime sleepiness, and daytime fatigue values were calculated for the week following the home visit (approximately 31 weeks gestation). Aggregate values were created by averaging data from the seven days of AM and PM sleep diary data collected during the week following the home visit.

To answer the second research question, frequencies were calculated for each infant sleep location. Additionally, thematic analysis was completed to detect common themes within the responses gathered on infant sleep location decisions. Thematic analyses was chosen to provide a rich description of the data collected in this study. As identified in Braun and Clarke (2006), an inductive (e.g., bottom-up) approach to analyzing the reasons for choosing infant sleep location at 30 weeks gestation was chosen. Once the data were collected, responses were analyzed to detect similar themes.

Given the limited sample size and power, no inferential statistics were completed to answer the third research question. However, the identified risk factors for poor sleep were analyzed at a descriptive level. Descriptive analyses were chosen to report on risk factors for poor sleep during pregnancy due to the limited sample size, including socioeconomic background, Body Mass Index (BMI), and depressive symptoms. Additionally, BMI and symptoms of depression were plotted in comparison to aggregate daily diary sleep quality values, which are provided in Appendix B.

Results

The first aim of the current study was to identify global and specific sleep patterns during the third trimester of pregnancy for this sample of adolescent mothers. PSQI data reflect appraisals of sleep across the past month (Buysse et al., 1989). For this sample of adolescent mothers, the mean PSQI score was 3.67 (SD = 1.63), which is below the cut-off score of 5.00

that is indicative of "poor sleep." However, 50% of the sample reported a PSQI score of 5.00, which suggests that half of participants were experiencing "poor sleep" during the 30 days prior to the home visit. It should be noted that none of the participants in this sample reported using sleep aids or medication to fall asleep during the month prior to the home visit. Mean sleep duration was 9.08 hours (SD = 2.50 hours). However, the majority (66.7%) of participants had elevations on the PSQI sleep disturbance subscale (n = 4, 66.7% had scores of at least 2.00 on the sleep disturbance subscale of the PSQI). The most commonly endorsed cause of nighttime sleep disturbance was "difficulty breathing" (n = 4, 66.7%) one or more times per week. However, no participants reported difficulty sleeping due to coughing or snoring loudly. Lastly, 50% of participants reported having a partner sleep in the same bed at the time of the home visit. Table 1, provided in Appendix A, includes person-level information collected from the PSQI.

During the seven days following the home visit at approximately 31 weeks gestation, participants reported obtaining an average 8.60 hours (SD = 2.43 hours) each night on the daily sleep diaries (range: 3-13 hours). Table 2, provided in Appendix A, includes a full description of person-level sleep diary data. Because of the small number of participants and because an ordinal scale was used to record measures of sleep quality, mode and range are reported for each participant (see Table 2). Modal values for sleep quality ratings ranged from three to ten with two participants reporting multiple modes for their sleep quality ratings across the week. For this sample, the mode of modes is 10 hours sleep per night, meaning that the majority of these women got 10 hours of sleep on most nights. As with daily sleep quality ratings, reports of sleepiness and fatigue were reported on an ordinal scale ranging from one to ten (highest value). Modal values for daily sleepiness ratings ranged from one to 10 with no participants reporting more than one mode for daytime sleepiness. However, as seen in Table 2, the modes for

sleepiness ratings are located at the extreme ends of the scale, suggesting it was common for participants to either feel only slightly fatigued or extremely fatigued during the day. In contrast, participant reports of mode for fatigue ranged from one to eight. The majority of participants reported a modal fatigue rating at the low end of the scale (e.g., lower ratings of daytime fatigue). Two participants reported bimodal values of daytime fatigue ratings across the seven days of daily sleep diary data collection.

The second aim of the current study was to investigate co-sleeping intentions and the motivations behind the chosen infant sleep locations in this sample of adolescent mothers. During the home visit, participants reported on their plans for infant sleeping location and the reason(s) for the chosen locations. The majority of participants (83.3%) reported their infant would sleep in a crib or bassinet in the mother's bedroom once born. One participant (16.7%) endorsed intention to bedshare once the baby was born by reporting the baby would sleep in bed with the mother after delivery.

In addition to descriptive, quantitative analysis of infant sleeping locations, the current study aimed to identify and describe the motivations or reasons for the chosen sleeping locations for these babies. Participants were asked why they planned to have their baby sleep in the location they chose (either in a crib/bassinet in their room or in the same bed) via an open-ended survey question. Based on an inductive approach (bottom-up) identified by Braun and Clarke (2006), thematic analysis was employed to explore the reasons for infant sleeping locations in this sample. Reasons for chosen sleeping locations fell into three categories: distance and/access, preparation, and safety. The majority (66.7%) of participants reported choosing their infant sleep location based on distance and/or access reasons (e.g., "to be close during the night"). One participant (16.7%) reported choosing their infant's sleep location for preparedness reasons (e.g.,

"area for baby not quite ready yet"). Lastly, one participant (16.7%) reported choosing their infant's sleep location for safety reasons. Table 3, provided in Appendix A, includes cited bedsharing motivations to indicate how they were coded.

The third aim of the current study was to analyze the relationship between the identified risk factors and sleep quality during pregnancy. However, given the limited sample size and statistical power, no inferential statistics were completed to address this aim. Despite an inability to perform correlational analyses between global sleep quality, as measured by the PSQI at the home visit, and the identified risk factors, valuable information can be provided regarding these risk factors in the study sample. We predicted that SES would predict poor sleep quality (Hypothesis 1). However, there was little variability in markers of SES in this sample. For instance, 100% of the participants in the sample endorsed eligibility for supplemental food programs (WIC), and 50% reported receiving WIC services at the time of the home visit. Data on current educational and vocational information was also collected at the home visit. Half of the mothers (50%) reported attending school at the time of the home visit, and none (0%) of the participants were working at the time of the home visit.

We predicted that BMI would predict poor sleep quality (Hypothesis 2). Two BMI values were calculated for each participant, pre-pregnancy BMI and current BMI. However, one participant did not report on pre-pregnancy weight so the current study obtained pre-pregnancy BMI data for five participants. Prior to becoming pregnant, participants reported an average BMI of 22.11 (SD = 2.68), which falls in the Normal BMI range according to the National Institutes of Health (NIH). On average, participants gained 30.62 pounds between pre-pregnancy and third trimester periods (SD = 12.3 pounds). Lastly, participants reported an average BMI of 30.31 (SD = 7.32) at the home visit around 30-31 weeks gestation. Although we did not conduct statistical

tests of the relationship between BMI and sleep quality, we have plotted a visual representation of the BMIs recorded during the home visits and sleep quality, as reported on the sleep diaries. In order to maximize information, BMI is plotted in relation to each participant's mean, mode, and range of sleep quality (see Figure 1 provided in Appendix B). As can be seen in Figure 1, the pattern of data suggest that lower BMIs may be associated with higher sleep quality, but that there is a high degree of between- and within-person variance.

The current study also assessed depressive symptoms during the third trimester, as measured by the Edinburgh Postnatal Depression Scale (EPDS; Cox et al., 1987). We predicted that higher levels of depression would predict poor sleep quality (Hypothesis 3). At the time of the home visit, participants reported an average EPDS score of 5.67 (SD = 3.72). Participant EPDS scores ranged from 3 to 13, which indicated that it is likely one or more participants were experiencing symptoms of depression during the third trimester. Research suggests that a score of 10 or higher is indicative of possible depression (Cox et al., 1987). Although no participants reporting experiencing thoughts of harming themselves or others during the week prior to the home visit, participants did report more frequent symptoms of anxiety and depression.

For example, 50% of the sample reported not looking forward with enjoyment to things that had been enjoyed in the past. One-third (33.3%) of the sample reported feeling anxious or worried and scared or panicky "for no good reason" at some points during the week prior to the home visit. Lastly, the majority (66.7%) of the sample endorsed difficulty coping at times during the week prior to the home visit. Similar to examining the relationship between BMI and sleep quality, we have plotted a visual representation of the depression symptoms recorded during the home visits and sleep quality, as reported on the sleep diaries. In order to maximize information, depression symptoms are plotted in relation to each participant's mean, mode and range of sleep

quality (see Figure 2 provided in Appendix B). As can be seen in Figure 2, the pattern of data suggest that lower levels of depression symptoms may be associated with higher sleep quality, but that there is a high degree of between-and within-person variance.

Discussion

The purpose of the current study was to investigate and describe global and specific aspects of sleep quality during the third trimester of pregnancy in a sample of high-risk, diverse adolescent women participating in a longitudinal pilot study testing the feasibility of a multiple health behavior change intervention. An additional purpose of the current study was to identify intentions to bedshare and the motivations behind the chosen infant sleeping locations during the third trimester of pregnancy. As anticipated, global sleep patterns varied across the sample, including level of sleep disturbance, sleep duration, sleep quality, and the presence of a bed partner or roommate. All participants in the current study reported an intention to co-sleep (i.e., bedshare or room share) with their infant once born. Qualitative analyses showed that co-sleeping intentions that fell into three categories: distance and/access, preparation, and safety.

Thus, the results of the current study offer insight into self-reported global and specific patterns related to sleep during the later stages of pregnancy, as well as the factors that may influence sleep during pregnancy for expecting teen mothers. Furthermore, the results of the current study demonstrate the importance of assessing co-sleeping intentions (i.e., bedsharing and room-sharing) in this specific population of expectant mothers. However, given concerns about representativeness and sample size, the results cannot be generalized to other adolescent mothers at this time.

Sleep During Pregnancy

Consistent with previous research, the majority of this sample of young mothers reported sleep disturbance during the third trimester of pregnancy. During the 30 days prior to this study, global sleep quality for half of the sample exceeded the cut-off score for "poor sleep". Yet, none of the participants reported use of sleep medication during the month prior to the home visit. This is inconsistent with studies showing that pregnant women may make up a large portion of adults using sleep-aid medication (Okun, Ebert, & Saini, 2015). These results are also not consistent with a study that discovered 9% of a non-pregnant adolescent sample had received a prescription for a schedule IV anxiolytic or sleep medication during their lifetime (Boyd, Austic, Epstein-Ngo, Veliz, & McCabe, 2015). Although none of the mothers endorsed use of any sleep-aid-specific medication(s) in the study, it is possible that participants used other prescription or over-the-counter medications and experienced tranquilizing or sedating effects around bedtime (e.g., allergy relief medications) but did not report the use of these medications in the study.

Despite indicators of poor sleep, mothers in the current study reported an average of nine hours of sleep during the late-second and early-third trimesters as assessed by the PSQI. Consistent with the PSQI, mothers reported a similar average sleep duration during the week following the home visit via daily sleep diaries. These results are not consistent with reports of decreased sleep duration during the third trimester of pregnancy in adult samples (Facco et al., 2010; Hutchinson et al., 2012). However, participant reports of sleep duration ranged from as low as three hours to as high as 13 hours during the night on the daily sleep diaries. As seen in Table 2, only two participants reported a minimum sleep duration of nine hours at night. Half of the sample reported a minimum sleep duration of five hours, and one participant reported sleeping three hours at night on the daily sleep diaries. Yet it is not clear whether these reports of decreased sleep duration are due to factors related to pregnancy (e.g., discomfort while lying

down, restroom breaks during the night, etc.) or other developmentally-appropriate behaviors (Owens & Adolescent Sleep Working Group, 2014).

Although nine hours may seem to be an adequate total sleep duration, it is important to note that the National Sleep Foundation (NSF) recommends adolescents get more sleep than adults. Specifically, the NSF recommends that non-pregnant adolescents aged 14 to 17 years sleep eight to ten hours per night and young adults (aged 18 to 25 years) sleep seven to nine hours per night (Hirshkowitz et al., 2015). Recommendations are based on evidence suggesting adolescents have an increased sleep requirement because of the effects of puberty on growth and development (as cited in Pieters et al., 2014). We know of no similar recommendations about the additional sleep requirements for pregnant teens. Thus, one interpretation of the results is that, compared to pregnant adult women, these young women were sleeping well (or at least for a longer duration). However, another interpretation of the data, paired with the NSF sleep duration recommendations, suggests it might be more appropriate for these adolescent mothers to meet the upper-bound range of the NSF recommendation for individuals aged 14 to 17 years.

It is important to note that the majority of the sample reported increased levels of sleep disturbance on the PSQI during the month prior to the home visit. Research suggests that sleep disturbance during pregnancy can be associated with many factors including hormonal shifts and physical discomforts (e.g., frequent urination, leg cramps, and fetal movement; Mindell & Jacobson, 2000). In this sample, it is likely that the elevated sleep disturbance levels were due to physical discomforts. In fact, two mothers reported that their sleep had been disturbed by a "lack of comfort" during the second and third trimesters of pregnancy, which is consistent with previous research (Mindell & Jacobson, 2000). Perhaps more importantly, approximately 70% of women reported that their sleep was disrupted by trouble breathing. Although they did not report

snoring, trouble breathing might signal the presence of sleep-disordered breathing during pregnancy, which can pose a health risk to both mother and baby.

Although approximately half of the sample scored in the "poor sleep" range of the PSQI (Buysse et al., 1989), this did not necessarily translate into reports of poor subjective sleep quality on a day-to-day basis. The majority of participants reported high levels of sleep quality at least on some nights, which is not consistent with previous research in adult samples of pregnant women (Facco et al., 2010; Hutchinson et al., 2012). Research suggests that sleep quality declines across pregnancy. That said, it is important to note the range and variability of self-reported sleep quality scores during this week. Across individuals, modal sleep quality ranged from three to ten, suggesting a high degree of variability in sleep quality during a few weeks of the third trimester. Although the current study did not gather potential reasons for decreased sleep quality, it is possibly due to physical discomforts (e.g., difficulty breathing) (Facco et al., 2010; Hutchinson et al., 2012). Given the lack of studies examining sleep behavior in diverse samples of pregnant adolescents and the research which suggests potential negative consequences of poor sleep during pregnancy (Chang et al., 2010), it is critical to characterize patterns of sleep and sleep problems in in this sample of high-risk young women. Although this sample is small, it suggests that when compared to adult women, adolescents may have longer sleep durations on average, but with a high degree of variability in sleep duration and sleep quality.

Bedsharing

In addition to providing information about sleeping patterns during late-second and early-third trimesters for a sample of adolescent, expectant mothers, the current study offers additional insight into a controversial topic related to women's health: bedsharing. Terms such as co-

sleeping, bedsharing, and roomsharing have been used interchangeably in previous research (McKenna & Volpe, 2007), and these terms are not synonymous. Although these behavioral patterns are similar in nature, previous research suggests the prevalence rates vary by definition and ethnic group (Brenner et al., 2003; Germo et al., 2007; Jenni et al., 2005; Lozoff et al., 1984; Mitchell et al., 2015; Schachter et al., 1989).

In this sample, all of the teen mothers endorsed co-sleeping. Specifically, these mothers reported that they planned for their infant to sleep in a crib or bassinet in their room. This rate of co-sleeping is higher than rates identified in previous research, including rates reported by samples of primarily African American and Hispanic families (Brenner et al., 2003; Lozoff et al., 1984, Schachter et al., 1989). One mother endorsed a plan to bedshare, meaning that the baby would sleep in the same room and on the same surface as the mother, which is, however, consistent with previous studies of bedsharing during the baby's first year of life in samples of adult women (Germo et al., 2007; Jenni et al., 2005; Lozoff et al., 1984; Mitchell et al., 2015). In a broader societal context, rates of parent-infant bedsharing have been increasing steadily since the early 1990s (Colson et al., 2013). Of important note is intentional versus unintentional bedsharing. Although only one mother reported intentions to bedshare in the current study, previous research suggests that the majority of mothers reported unintentional bedsharing during the infant's first few months of life (Krouse et al., 2012). It is critical to estimate the prevalence of both intentional and unintentional bedsharing as a way to better understand how bedsharing is related to increased risk for SIDS (Colson et al., 2013).

Mothers choose to engage in co-sleeping patterns for a number of reasons. However, the motivations behind these patterns of behavior are largely unknown for adolescent mothers. Consistent with previous studies, the mothers in the current study reported intention for co-

sleeping because of distance and access to the infant (Germo et al., 2007). Germo and colleagues (2007) discovered that both mothers and fathers reported a desire for physical proximity when indicating bedsharing as the planned infant sleeping location. Although mothers in the current study did not provide explicit details about the desire for closeness, it is likely that mothers want to be close to their babies for a number of reasons. For example, samples of adult mothers have reported convenience as a reason for bedsharing given recovery from delivery and breastfeeding, for example (Germo et al., 2007; Joyner et al., 2010). Additionally, mothers have reported physical closeness as a motivator for bedsharing given concerns for maternal and infant emotional security (Chianese et al., 2009). Interestingly, emotional security was not reported as motivations behind co-sleeping and bedsharing in the current study's sample of expecting adolescent mothers.

Although in most respects, teen mothers' motivations to bedshare were similar to older and lower risk mothers, there were other ways in which this population was distinct. One mother reported that she planned to bedshare because she was "unprepared "for the birth of her child, despite being in her third trimester (e.g., 30-31 weeks gestation). It is possible that the lack of preparation was related to developmental immaturity. However, it may also be that intention to bedshare was motivated by financial worries about the ability to buy a crib or bassinet (Brenner et al., 2003; Joyner et al., 2010). Relatedly, it became apparent that temporary housing and mobility were risks that were specific to this group of young mothers. Anecdotal evidence suggests that these mothers faced challenges in preparation throughout their pregnancy, including reports of a stolen crib during a family gathering and being kicked out of the family home due to pregnancy. Also, somewhat unique to this sample was one mother's decision to co-sleep because of concerns about safety if the baby were to sleep in another room. Relatedly,

evidence suggests that urban poor mothers may be more likely to engage in unsafe bedsharing practices (McKenna & Volpe, 2007). Given concerns about developmental maturity, financial security, and resources during adolescent motherhood, this specific population may be extremely vulnerable to factors that affect health behaviors associated with maternal and infant outcomes.

Previous research, paired with the results of the current study, strongly emphasize the importance and need for information regarding safe co-sleeping practices within families. The relationship between co-sleeping (i.e., roomsharing, not bedsharing) and reduced risk for sudden infant death syndrome (SIDS) is now fairly well known (McKenna & McDade, 2005). Yet, not assessed given the scope of the current study, a growing body of research also suggests that maternal sleep quality may be compromised by safe parent-infant co-sleeping practices (Lillis et al., 2016). Furthermore, the results of the current study suggest that mothers may be aware of safety concerns related to co-sleeping practices. However, this is a double-edged sword. Anecdotal evidence suggests that mothers that intend to bedshare may not discuss this decision with their physician or medical care provider for fear of being scolded or reprimanded. Fear of disapproval may be a particularly strong barrier for high-risk, adolescent mothers. This is unfortunate because it prevents patient-provider problem-solving to maximize education and safety for these families.

In summary, the results of the current study suggest that adolescent mothers may choose co-sleeping or bedsharing during their last trimester of pregnancy, and these mothers choose these sleeping patterns for a number of reasons. The motivations behind co-sleeping and bedsharing suggest concerns about distance and access to the baby, preparation, and safety of the baby. Some of these reasons for co-sleeping and bedsharing have been replicated in adult samples of mothers and samples of predominantly minority women (i.e., concerns about safety

and proximity to infant), yet no published studies investigating the motivations for co-sleeping between teen mothers and their babies have been identified to this point. This is important for future research as the results of the current study suggest that teen mothers are likely to co-sleep for similar and unique reasons that differ from adult mothers.

Factors Affecting Sleep During Pregnancy

The current investigation also sought insight about the factors that can affect sleep during pregnancy. Although no predictive relationships were tested, descriptive data can be used to inform future work. Research in non-pregnant adult samples demonstrates a significant relationship between socioeconomic status (SES) variables (e.g., living alone, low social status, lower income levels, minority racial status, and long work hours) and sleep (Kushida, 2004). Less research has examined these relationships during pregnancy, which highlights a need for future research on the relationship between SES and sleep for pregnant women. In the current investigation, all participants reported eligibility for the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC), which is a federally-funded program that offers resources to at-risk and low-income pregnant and postpartum women and their families (Besharov, & Germanis, 2001). Only half of the mothers reported receiving WIC services during study participation, indicating pregnant adolescents may receive help from other sources. Relatedly, none of the mothers in the sample reported working at the time of study participation (i.e., 30-31 weeks pregnant). Half of the mothers reported attending school at the time of study participation. It is important to note that about half of participants were 18 years or older at the time of the study, so it is likely that these mothers were no longer in high school. Although there are limited data, studies conducted with non-pregnant women suggest educational level is related to sleep and other health outcomes (Friedman et al., 2007). Thus, it is likely that educational

involvement during teen pregnancy may also be related to global and specific sleep patterns. Future work should target the assessment of SES variables and sleep in order to determine if these factors affect sleep and other health outcomes during pregnancy for adolescent women.

The current investigation also highlights the role of physical and mental health indicators during pregnancy for adolescent mothers. Previous research suggests that weight status, particularly overweight or obese weight status, measured by Body Mass Index (BMI), is related to sleep quality in samples of non-pregnant (Sahlin et al., 2009) and pregnant women (Facco et al., 2010). Although the current study did not test the relationship between BMI and sleep quality during pregnancy, the results and visual representation of these data highlight the importance of assessing these variables for adolescent mothers. The current study examined pre-pregnancy BMI and BMI at the time of study participation for each mother. On average, participants reported normal pre-pregnancy BMIs. The average weight gain across pregnancy was 30 pounds, which is considered in the recommended range of 25-35 pounds for women starting out at a healthy weight before pregnancy (CDC, 2014). However, it is also known that many women gain more than the recommended amount of weight during pregnancy (as cited in Reid et al., 2016).

That said, the participants in the current investigation, on average, measured a BMI of 30 at the time of the home visits during the third trimester. As can be seen in Figure 1, provided in Appendix B, there was a high degree of between-person variance in BMIs at the time of the home visit. Moreover, the pattern of data within Figure 1 demonstrate a potential inverse relationship between BMI and sleep quality during pregnancy in this sample. Given research to suggest that overweight status during pregnancy can negatively affect sleep (Facco et al., 2010), it is important for future work to continue to identify the relationships between physical health characteristics and sleep during pregnancy. This is especially important for adolescent women

given studies suggest teen mothers have a more difficult time losing weight after delivery (Black et al., 2006).

The current investigation also offers insight into the mental health functioning of this sample of primiparous, adolescent women. As assessed by the Edinburgh Postnatal Depression Scale (EPDS; Cox et al., 1987), results suggest that mothers in this sample were experiencing mild to moderate symptoms of distress at the time of the home visit. Furthermore, approximately one-third of the sample endorsed feelings of anxiety and/or panic. Results of previous studies suggest that mothers who report low or depressed mood during the second trimester also report higher levels of sleep disturbance during pregnancy (Field et al., 2007).

Although the current study did not analyze the relationship between mood and sleep, a visual representation of the data, see Figure 2 provided in Appendix B, reflects a potential inverse relationship between depression and sleep during pregnancy for adolescent women. These results highlight the idea that pregnant women reporting fewer symptoms of depression may also report better sleep quality during the third trimester of pregnancy. Additionally, the results of the current study demonstrate the benefit of assessing sleep quality during pregnancy with daily sleep diaries. Future work should continue to examine the relationship between mental health functioning and sleep during pregnant for adolescent women, including the use of daily sleep monitoring to gather these data. Given the majority of the sample endorsed difficulty coping with life at times throughout study participation, it is apparent that teen mothers may benefit from interventions designed to target mood, coping, healthy diet and exercise choices, and sleeping patterns during pregnancy.

Limitations

Although the current investigation offers insight into sleep during pregnancy and co-sleeping intentions for adolescent mothers, the results should be evaluated in light of methodological considerations. First, the current study did not account for prior maternal sleep problems. While the findings of this study suggest some teen mothers may experience lower levels of sleep quality and quantity during the second and third trimesters, it is impossible to rule out the influence of problematic pre-pregnancy sleep patterns. Thus, future work should collect data on pre-pregnancy sleep problems (e.g., pre-pregnancy sleep quality and duration).

Furthermore, future work should target the assessment of pre-existing health conditions in this population. The current study did not assess for global health conditions, such as diabetes mellitus, and the potential impact of these health conditions on sleep during pregnancy in this sample. Evidence suggests that problematic sleep (e.g., poor sleep quality, fragmentation, sleep disturbance) negatively affects glucose metabolism and risk for and severity of diabetes condition in non-pregnant (Reutrakul, & Van Cauter, 2014) and pregnant (Facco, Grobman, Kramer, Ho, & Zee, 2010) populations. Given higher prevalence rates of chronic health conditions in minority racial groups (Rocca et al., 2014), paired with extant literature on the influence of health conditions on problematic sleep, it is critical for future work to assess the potential role of chronic health conditions on sleep during pregnancy for young, high-risk pregnant women.

Additionally, the current investigation relied solely on maternal report of sleep and bedsharing patterns. Previous research suggests that self-reported aspects of sleep and more objective measures are moderately correlated (Lauderdale, Knutson, Yan, Liu, & Rathouz, 2008), yet it is possible that maternal reports were not as accurate as other objective sleep assessments. It is also possible that mothers were not accurate in their reporting of global and

specific sleep patterns across the end of the second and beginning of the third trimesters due to factors associated with pregnancy (e.g., fatigue). A recent study found that pregnant and postpartum mothers reported higher levels of perceived problems with memory compared to the control participants (Logan, Hill, Jones, Holt-Lunstad, & Larson, 2014). Thus, it is also possible that mothers may not accurately reported specific sleep patterns on daily diary dues to memory complaints during the late stages of pregnancy. However, the current investigation made adjustment for these potential factors by assessing specific sleep domains across seven days following the home visit to compliment the self-reported data assessing sleep patterns over the month prior to the home visits. To avoid potential problems with self-report data, future work should incorporate the use of both subjective and objective measures of global and specific patterns of sleep during pregnancy.

Lastly, given the limited sample size for the current investigation, there are serious concerns about the representativeness this group of young mothers. The results cannot be generalized to other adolescent women at this time due to sample size concerns. When investigating sleep patterns and co-sleeping intentions in this population, future work should target replication of these results in larger samples of teen mothers, as well as investigate the predictive validity of risk factors that can affect sleep during pregnancy. Both quantitative and qualitative analyses were conducted in order to best collect information on global and specific sleep patterns during pregnancy and maternal intentions and motivations to engage in co-sleeping behaviors with infants. Future work, given the difficulty in recruiting samples of diverse, expecting adolescent women, should consider a case-study approach. It is possible additional data can be collected in smaller samples with a case-study approach. Furthermore, future work should also consider the continued use of open-ended questions in this population. It

is possible that an open-ended, case-study approach to studying sleep quality and co-sleeping intentions during pregnancy can offer additional insights on these psychosocial health behaviors.

Conclusions and Future Directions

The current study adds to a body of literature on the trajectory of sleep patterns during pregnancy, specifically for adolescent mothers. Furthermore, the current investigation offers insight into the plans teen mothers may have for their babies once born, as well as the motivations behind these chosen sleeping locations. Despite methodological limitations, the results of the current study have implications for maternal and infant health and sleep outcomes, as well as information for healthcare providers. Given the identified negative outcomes of poor sleep during pregnancy (Chang et al., 2010), as well as the established link between unsafe co-sleeping patterns and SIDS (McKenna & Volpe, 2005), it is critical to intervene as early as possible. It is imperative to identify and understand more about these sleeping patterns for adolescent women and their offspring. Although a recent poll suggests pediatricians are more likely to discuss topics such as infant sleep position and bedsharing at every visit compared to family physicians (Moon, Kington, Oden, Iglesias, & Hauck, 2007), there are still identified gaps in the awareness, knowledge, and dissemination of information about maternal and infant sleeping recommendations. The current study offers new information about the intended co-sleeping practices of a specific group of women within the pediatric population, teen mothers and their children.

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Appendix A

Table 1

Pittsburgh Sleep Quality Index (PSQI) Global and Subscale Scores

	Total Score (0-21)	Sleep Duration (0-3)	Sleep Disturbance (0-3)	Onset Latency (0-3)	Daytime Dysfunction (0-3)	Sleep Efficiency (0-3)	Global Sleep Quality (0-3)	Need Meds to Sleep (0-3)
P1	5.00	1.00	2.00	1.00	0.00	0.00	1.00	0.00
P2	3.00	0.00	2.00	0.00	1.00	0.00	0.00	0.00
P3	5.00	0.00	2.00	1.00	1.00	0.00	1.00	0.00
P4	5.00	0.00	2.00	1.00	1.00	0.00	1.00	0.00
P5	3.00	0.00	1.00	0.00	1.00	0.00	1.00	0.00
P6	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00

Note. Higher values reflect worse scores. "P" represents "Participant." Total scores of 5.00 or higher qualify as "poor sleep."

Table 2

Sleep Diary Reports of Sleep Duration, Quality, and Daytime Functioning

	Mean Sleep Duration in Hours (Range)	Sleep Quality Mode (Range)	Sleepiness Mode (Range)	Fatigue Mode (Range)
P1	6.71 (5-9)	5 (5-10)	9 (1-10)	1 (1-2)
P2	11.57 (9-13)	6,9,10* (6-10)	1 (1-9)	1,4* (1-9)
P3	8.71 (5-12)	10 (9-10)	3 (1-5)	2 (1-3)
P4	4.93 (3-6)	3 (2-7)	10 (2-10)	8 (5-9)
P5	10.43 (9-12)	8,9,10* (7-10)	7 (1-8)	1,3* (1-8)
P6	9.21 (5.75-11.5)	10 (7-10)	2 (1-4)	1 (1-6)

Note. *Multiple modes separated by comma(s). "P" represents "Participant."

Table 3

Quotes from Sample to Support Bedsharing Motivational Themes

Distance/Access	Preparedness	Safety
"Easier access as baby will be nearby"	"Area for baby not quite ready yet"	"Safest for baby"
"To be close during the night" "To be close to him"		
"Worried about having the baby where [mom] can't be near him"		

Appendix B

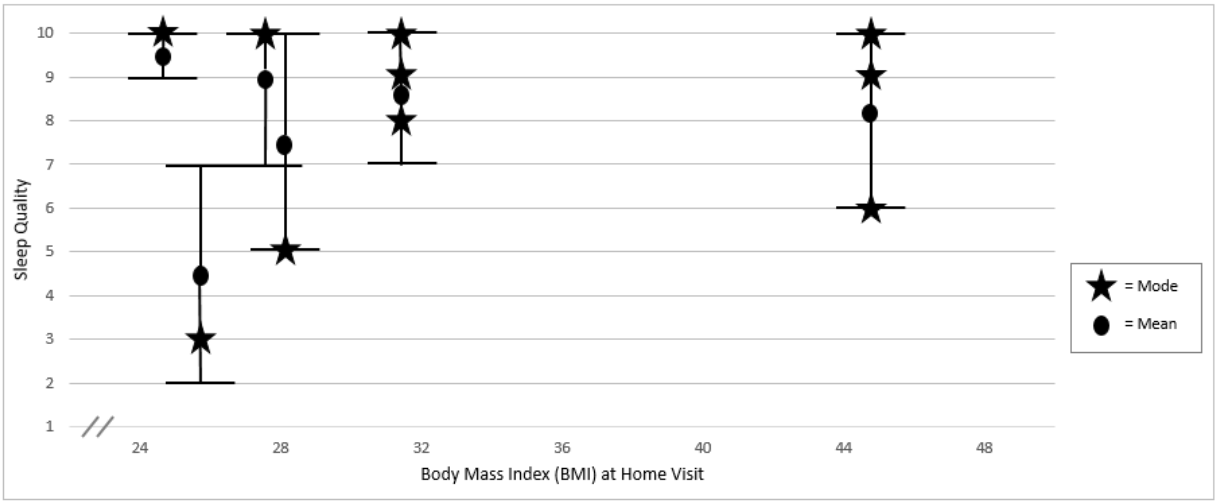

Figure 1. BMI and Sleep Quality Ratings.

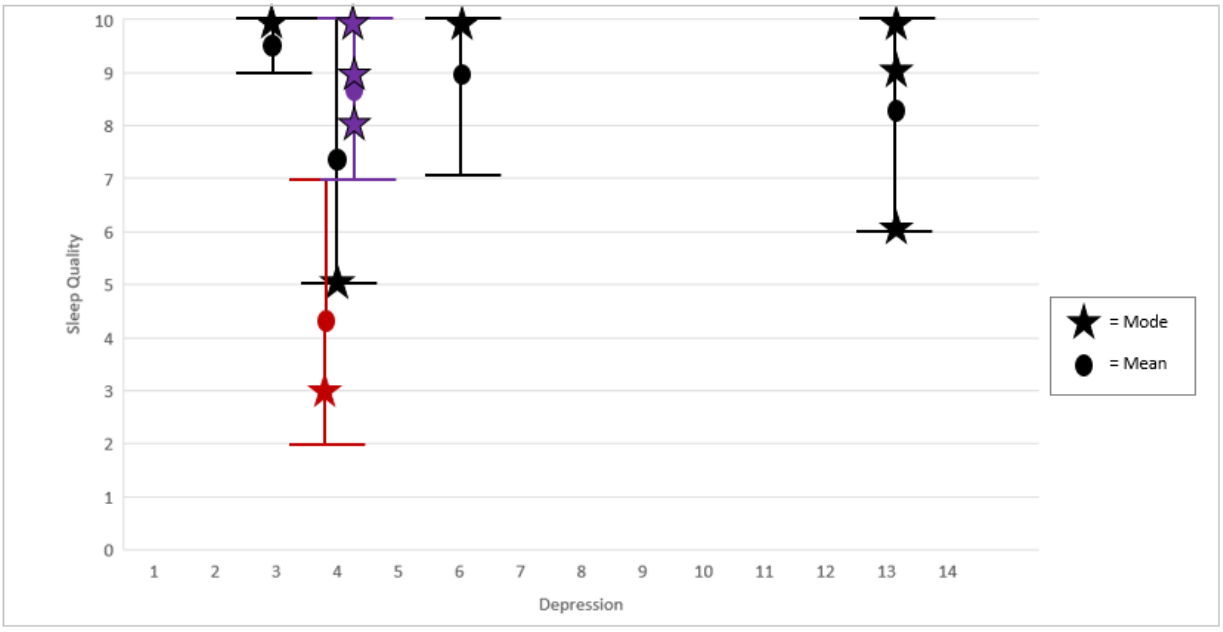

Figure 2. Depression (EPDS) and Sleep Quality Ratings.

Appendix C
iPad Agreement Form

The momHealth project is conducted by the University of Kansas Medical Center through the Schools of Nursing and Medicine. The project focuses on the use of iPad handheld computer tablets for applications specific to health education and for communication connections with pregnant women.

As a participant in the project, you understand and agree with the following:

1. The iPad is loaned to you by the research team at the University of Kansas School of Nursing for a limited period of time associated with the project, typically 12-14 weeks. The iPad remains the property of University of Kansas, Schools of Nursing, and will be returned at the completion of the study or should you choose to discontinue participation. The research assistant will work with you to find a good time for iPad drop off and pick up.
2. There is no cost to you for the loan of the iPad.
3. The research assistant X can assist you with general questions about the study and use of the iPad; her contact # is X. If you have technical questions, you may also contact our iPad technicians during regular business hours at (913) 588-2226. Please identify yourself as a study participant when calling so we can direct to the iPad specialist.
4. We welcome your use of the iPad to support you in information and resources related to breastfeeding, healthy lifestyle, and stress management as you prepare for your new baby. The iPads have study materials as well as internet access and we encourage use related to the study topic areas. Please be aware that we will ask you to review the iPad at the end of the study and ask you about websites, apps, or other uses that you may have used. Note that any apps that you add are at your expense and will be removed when the iPad is returned at the end of the project.
5. Any misuse, damage or loss of the iPad may interfere with other participant's ability to participate in this study. I agree to take reasonable steps in maintaining the iPad including:
    a. Ensuring the safety and security of the iPad
    b. Reporting issues with the iPad immediately for repair or replacement
    c. Returning the iPad tablet if deciding to no longer participate in the study
6. We also ask you to follow the standards of care set out by your own primary health care providers in relationship to the information on breastfeeding support, healthy living activities and stress management described in this study. No medical advice will be shared, as your full health information is not known.
7. We also ask you to refrain from illegal use of the iPad (i.e. computer hacking, communication harassment, accessing or creating illegal content, use while driving etc.). Any illegal use will result in immediate removal from the project. Such activity could result in possible legal action by authorities within the appropriate jurisdiction.
8. I have read and agree to the above statements and have received an Apple iPad, Serial # _____. Electronic tracking of this iPad identifies its location.

_____	_____	_____
Participant Name (Print)	Signature	Date

Note: There may be pop-up advertisements that will appear on the iPad, these are not controlled by the University of Kansas, Department of Pediatrics, but rather by the vendor who connects the iPad to the internet. These are routine with all tablet connections to the internet and can be ignored. Beware of purchasing or giving any personnel information out online.

Appendix D

Demographic Form

Please answer or check (X) in the blank regarding your personal information.

Prenatal Baseline:

1. What is your age? _____ years
2. What is your marital status?

_____ Married _____ Divorced
_____ Widowed _____ Separated
_____ Single _____ Living with partner

3. Who is involved in helping you during your pregnancy e.g. your mother, the baby's father, other people?

4. What's your highest level of completed education?

_____ Grade school (Kindergarten - Grade 6)
_____ Middle School
_____ High school
_____ Other (Please specify): _____

5. Who lives in your household? _____
6. Are you eligible for WIC services? _____Yes ____ No
7. Do you currently receive WIC services? _____Yes ____ No
8. Your baby's due date (mm/dd/yy) _____
9. Do you currently go to school? _____Yes ____ No
10. Do you currently have a job? _____ Yes _____No

Appendix E

Daily Sleep Diaries

PREPARTUM - Daily diary (AM) BASELINE ONLY

Where do you plan for your baby to sleep once s/he is born?

_____ In a crib or bassinette in my bedroom
_____ In a crib or bassinette in another room or bedroom
_____ In bed with me
_____ Other, please explain _____

Why do you plan to have your baby sleep in the location you indicated above (please indicate more than one reason if applicable)?

Please explain _____

PREPARTUM - Daily diary (AM)

How long did you sleep last night (please provide hours and minutes)?

Please indicate your quality of sleep last night (10 being the highest).

1 2 3 4 5 6 7 8 9 10

How many times did you wake up during the night?

1 2 3 4 5 6+

PREPARTUM – Daily diary (PM)

How many minutes did you nap today in total?

0-30 30-60 60-90 90-120 120+

How sleepy did you feel today (10 being very sleepy; sleepy means that you feel like you could fall asleep if given the opportunity)?

1 2 3 4 5 6 7 8 9 10

How fatigued did you feel today (10 being very fatigued; fatigued means how tired/exhausted/worn out you feel)?

1 2 3 4 5 6 7 8 9 10